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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/722,486	11/28/2003	Masato Hiramatsu	246036US2	3321
22850	7590	10/20/2005	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			KANG, DONGHEE	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 10/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/722,486	Applicant(s) HIRAMATSU ET AL.	
	Examiner Donghee Kang	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 5-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 & 12-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims **1-2, 12-15, 18 & 20-21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki et al. (US 5,962,869) in view of Yamazaki et al. (US 6,492,659).

Re claims 1-2, 12 & 15, Yamazaki teaches a semiconductor structure comprising (Fig.6) a non-single-crystal semiconductor film (602) including a channel region for an active device, and a support substrate (601) that supports the non-single-crystal semiconductor film, the channel region having an oxygen concentration not higher than 5×10^{17} atoms/cm³ and carbon concentration not higher than 5×10^{17} atoms/cm³ (Col.12, lines 59-62).

Yamazaki ('869) does not explicitly teach the channel region is located within a single crystal grain. Yamazaki ('659) teaches increasing the crystal grain size to eliminate the crystal boundaries from the channel forming region to reduce a crystal defects (Col.2, lines 2-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the channel region within the single crystal grain by increase the crystal grain size as taught by Yamazaki ('659) in order to

remove the crystal grain boundary in the channel region which reduces carrier current so as to obtain a high degree of mobility.

Re claim 13, Yamazaki teaches the active device is a thin-film transistor including source and drain regions (606 & 607) disposed on both sides of the channel region in the non-single-crystal semiconductor film, and a gate electrode layer (604) insulated from the channel region by an insulation film (603).

Re claim 18, Yamazaki teaches a semiconductor structure comprising (Fig.6) a non-single-crystal semiconductor film (602), a support substrate (601) that supports the non-single-crystal semiconductor film, and an active device having a part of the non-single-crystal semiconductor film as a channel region, the channel region having an oxygen concentration not higher than 5×10^{17} atoms/cm³. Yamazaki ('869) does not explicitly teach the channel region is located within a single crystal grain. Yamazaki ('659) teaches increasing the crystal grain size to eliminate the crystal boundaries from the channel forming region to reduce a crystal defects (Col.2, lines 2-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the channel region within the single crystal grain by increase the crystal grain size as taught by Yamazaki ('659) in order to remove the crystal grain boundary in the channel region which reduces carrier current so as to obtain a high degree of mobility.

Yamazaki ('869) as modified by Yamazaki ('659) does not explicitly teach a stacking fault (structural defect) density not higher than 1×10^6 cm⁻³. However, this

feature is inherent in Yamazaki's structure because the oxygen concentration of Yamazaki is also not higher than $1 \times 10^6 \text{ cm}^{-3}$.

Re claim 20, Yamazaki et al. teach the single-crystal grain has a direction of growing coinciding with a direction of arrangement of the source and drain regions.

Re claim 21, Yamazaki teaches source and drain regions (606 & 607) are disposed on both sides of the channel region in the non-single-crystal semiconductor film and the single-crystal grain has a direction of growing coinciding with a direction of arrangement of the source and drain regions.

3. Claims 3-4 & 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki et al. (US 5,962,869) in view of Yamazaki et al. (US 6,492,659) and further in view of Yamazaki et al. (US 2002/0038889).

Neither Yamazaki ('869) nor Yamazaki ('659) does not explicitly teach the channel region having metal element where a concentration of metal element is not higher than $5 \times 10^{16} \text{ atoms/cm}^3$. However, Yamazaki ('889) teaches that the channel region includes metal element having the concentration being less than $5 \times 10^{17} \text{ atoms/cm}^3$ (paragraph 0116 & 0160) to promote crystallization of the amorphous semiconductor film. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to introduce a metal element into channel region as taught '889 reference in order to promote crystallization of the amorphous semiconductor film.

Response to Arguments

4. Applicant's arguments with respect to claims 1-4 & 12-21 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 571-272-1656. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Donghee Kang, Ph.D.
Primary Examiner
Art Unit 2811

dhk